

MT 201 Phase Transformations

Spring 2007

Home Assignment 1

1. Draw the unit cell of *fcc* structure, and sketch the (222) plane nearest to the origin. Does it contain any atoms? Comment on the (222) peaks in the diffraction pattern of an *fcc* metal, such as aluminium.
2. Draw, **to scale**, the atomic structure of (100), (110) and (111) planes of (a) α -iron (*bcc*) and (b) γ -iron (*fcc*).
3. Draw the unit cell of an ideal *hcp* structure. Derive the c/a ratio of an ideal *hcp* crystal structure, and its packing factor.
4. In separate figures, draw the $(10\bar{1}0)$, $(11\bar{2}0)$, $(10\bar{1}1)$, $(11\bar{2}1)$, $(10\bar{1}2)$, $(11\bar{2}2)$ planes in a hexagonal unit cell.
Give the Miller indices (in the 'three-number' scheme) of these planes.
5. $L1_2$ structure is an ordered version of the *fcc* structure, in which corner positions are occupied preferentially by *B* atoms, and the face center positions are occupied by *A* atoms. If a phase (say, γ') with $L1_2$ structure is precipitated out from γ , a disordered *fcc* solid solution, find those planes and directions in γ' which are parallel to (100), (010), (110), (111), [100], [010], [110] and [111] in γ .
6. A planar interface between two phases γ and α , with *fcc* and *bcc* structures, respectively, is thought to be parallel to the close packed planes of the two phases, with the close packed directions being parallel. Draw, to scale, the atomic arrangement in these planes in the two structures.